PETG S2008

Glycol Modified Co-Polyester

October 10, 2001

Product Characteristics

<table>
<thead>
<tr>
<th>Material Status</th>
<th>✓ Commercially active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>✓ North America</td>
</tr>
<tr>
<td></td>
<td>✓ Europe</td>
</tr>
<tr>
<td></td>
<td>✓ Asia</td>
</tr>
<tr>
<td>Test Standard Available</td>
<td>✓ ASTM</td>
</tr>
<tr>
<td></td>
<td>✓ ISO</td>
</tr>
<tr>
<td>Additive</td>
<td>✓ Mold release</td>
</tr>
<tr>
<td>Recycled Content</td>
<td>✓ No</td>
</tr>
</tbody>
</table>

Features

- High transparency
- High gloss surface
- Low haze
- Good toughness
- Design freedom
- Good chemical resistance
- Outstanding printability
- Easy fabrication
- No stress-whitening
- Good processability

- Easy processing (maintenance cost saving)
- Short cycle time in thermoforming (improved productivity)
- Easy handling
- No waste of material (reusable of scrap)

- Recyclable
- No toxic fumes or odor
- Low smoke density and toxicity
### Uses (Applications)

<table>
<thead>
<tr>
<th>Film</th>
<th>Extrusion Blow Molding</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Blister packaging for stationery &amp; tools</td>
<td></td>
</tr>
<tr>
<td>✓ Personal care</td>
<td></td>
</tr>
<tr>
<td>✓ Food packaging container</td>
<td></td>
</tr>
<tr>
<td>✓ Electrical &amp; electronic packaging</td>
<td></td>
</tr>
<tr>
<td>✓ Pharmaceutical &amp; medical packaging</td>
<td></td>
</tr>
<tr>
<td>✓ Toys</td>
<td></td>
</tr>
<tr>
<td>✓ Refrigerator parts</td>
<td></td>
</tr>
<tr>
<td>✓ Electric &amp; electronic parts</td>
<td></td>
</tr>
<tr>
<td>✓ Smart cards</td>
<td></td>
</tr>
<tr>
<td>✓ Pen caps</td>
<td></td>
</tr>
<tr>
<td>✓ Medical devices</td>
<td></td>
</tr>
<tr>
<td>✓ Tools</td>
<td></td>
</tr>
<tr>
<td>✓ Bottles for packaging shampoos, soaps, detergents</td>
<td></td>
</tr>
<tr>
<td>✓ Bottles for pharmaceutical &amp; medical packaging</td>
<td></td>
</tr>
</tbody>
</table>

### Agency Rating (Regulation Status)

<table>
<thead>
<tr>
<th>FDA (U.S Food and Drug Administration) 21 CFR 177.1315 (b) 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ In contact with foods, including foods containing no more than 25 vol.% aqueous alcohol, excluding carbonated beverages and beer</td>
</tr>
<tr>
<td>✓ Hot fill not exceed 82.2°C (180°F), storage at temp. not in excess of 48.9°C (120°F)</td>
</tr>
<tr>
<td>✓ No thermal treatment in the container</td>
</tr>
<tr>
<td>✓ In actual applications. Alcoholic content do not exceed 15% for alcoholic food contact articles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Specific migration of relevant components after contact period of half hour at 70°C and subsequently for 10 days at 40°C.</td>
</tr>
<tr>
<td>: 3% acetic acid</td>
</tr>
<tr>
<td>: 15% ethanol</td>
</tr>
<tr>
<td>: olive oil</td>
</tr>
<tr>
<td>✓ PETG S2008 is suitable for contact with aqueous, acidic, ethanolic (up to 15%) and fatty foodstuffs for half hour at 70°C and subsequently for any time at room temperature.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UL(Underwriters Laboratories) 94</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ UL File No: QMFZ2. E215991</td>
</tr>
<tr>
<td>✓ HB : Minimum thickness 1.6 mm</td>
</tr>
<tr>
<td>✓ V-2: Minimum thickness 3.2 mm</td>
</tr>
</tbody>
</table>
### Appearance & Forms

<table>
<thead>
<tr>
<th>Appearance</th>
<th>✓ Clear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Color available</td>
</tr>
</tbody>
</table>

| Forms        | ✓ Spherical pellets |

### Processing Method

<table>
<thead>
<tr>
<th>Primary Processing</th>
<th>✓ Extrusion (Film)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Extrusion (Profile)</td>
</tr>
<tr>
<td></td>
<td>✓ Extrusion (Compounding)</td>
</tr>
<tr>
<td></td>
<td>✓ Extrusion Blow Molding</td>
</tr>
<tr>
<td></td>
<td>✓ Injection Molding</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Fabrication</th>
<th>✓ Thermoforming</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ Welding</td>
</tr>
</tbody>
</table>
## Product Data Sheet S2008

### Injection Molded Property (ASTM Method)

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>ASTM D792</td>
<td>-</td>
<td>1.27</td>
</tr>
<tr>
<td>Mold Shrinkage Parallel to Flow</td>
<td>ASTM D955</td>
<td>%</td>
<td>0.3 - 0.6</td>
</tr>
<tr>
<td>Rockwell Hardness</td>
<td>ASTM D785</td>
<td>R-scale</td>
<td>110</td>
</tr>
<tr>
<td>Water Absorption (24 hr immersion)</td>
<td>ASTM D570</td>
<td>%</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensile Strength @ Yield 50mm/min (2 inch/min)</td>
<td>ASTM D638</td>
<td>MPa (kgf/cm²)</td>
<td>50 (510) 7300</td>
</tr>
<tr>
<td>Tensile Strength @ Break 50mm/min (2 inch/min)</td>
<td>ASTM D638</td>
<td>MPa (kgf/cm²)</td>
<td>28 (290) 4100</td>
</tr>
<tr>
<td>Elongation @ Break 50mm/min (2 inch/min)</td>
<td>ASTM D638</td>
<td>%</td>
<td>140</td>
</tr>
<tr>
<td>Flexural Strength 1.27mm/min (0.05 inch/min)</td>
<td>ASTM D790</td>
<td>MPa (kgf/cm²)</td>
<td>73 (745) 10600</td>
</tr>
<tr>
<td>Flexural Modulus 1.27mm/min (0.05 inch/min)</td>
<td>ASTM D790</td>
<td>MPa (kgf/cm²)</td>
<td>2110 (21500) 305000</td>
</tr>
<tr>
<td>Izod Impact Strength, Notched @ 23 °C(73 °F)</td>
<td>ASTM D256</td>
<td>J/m(kgf·cm/cm)</td>
<td>100 (10.2) 1.88</td>
</tr>
<tr>
<td>Impact Resistance (Puncture) Energy Max. Load in 3.2mm Thick Plaque (0.125 inch) at 23 °C(73 °F), 220mm/min.</td>
<td>ASTM D3763</td>
<td>ft lbf/in.</td>
<td>33</td>
</tr>
</tbody>
</table>

### Thermal

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Distortion Temperature @ 0.455 MPa(66 psi)</td>
<td>ASTM D648</td>
<td>°C (°F)</td>
<td>70 (158)</td>
</tr>
<tr>
<td>@ 1.82 MPa(264 psi)</td>
<td></td>
<td>°C (°F)</td>
<td>64 (147)</td>
</tr>
<tr>
<td>Vicat Softening Temperature @ 1kg load</td>
<td>ASTM D1525</td>
<td>°C (°F)</td>
<td>85 (189)</td>
</tr>
<tr>
<td>Glass Transition Temperature (Tg)</td>
<td>DSC method</td>
<td>°C (°F)</td>
<td>80 (176)</td>
</tr>
</tbody>
</table>

### Electrical

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Strength (Short-time, 500v/sec.)</td>
<td>ASTM D149</td>
<td>kV/mm (V/mil)</td>
<td>16 (410)</td>
</tr>
<tr>
<td>Volume Resistivity</td>
<td>ASTM D257</td>
<td>Ohm cm</td>
<td>10¹⁵</td>
</tr>
<tr>
<td>Surface Resistivity</td>
<td>ASTM D257</td>
<td>Ohm</td>
<td>10¹⁶</td>
</tr>
<tr>
<td>Dielectric Constant @ 1kHz</td>
<td>ASTM D150</td>
<td>-</td>
<td>2.6</td>
</tr>
<tr>
<td>@ 1MHz</td>
<td></td>
<td></td>
<td>2.4</td>
</tr>
<tr>
<td>Dissipation Factor @ 1kHz</td>
<td>ASTM D150</td>
<td>-</td>
<td>0.005</td>
</tr>
<tr>
<td>@ 1MHz</td>
<td></td>
<td></td>
<td>0.023</td>
</tr>
<tr>
<td>@ 1MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Flammability

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL Flammability Classification @ min. 1.6 thickness</td>
<td>UL 94</td>
<td>-</td>
<td>HB</td>
</tr>
<tr>
<td>@ min. 3.2 thickness</td>
<td></td>
<td></td>
<td>V-2</td>
</tr>
</tbody>
</table>

The data listed here fall within the normal range of product properties, but they should not be used to establish specification limits or used alone as a basis for design. This information is not intended as a warranty of any kind. Customers must make their own representative test and assume all risks of use, whether used alone or in combination with other products.
# Product Data Sheet of S2008

- **Film Property (ASTM Method)**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of Film Tested</td>
<td>ASTM D374</td>
<td>Micron (mil)</td>
<td>250 (10)</td>
</tr>
<tr>
<td>Intrinsic Viscosity of Film Tested</td>
<td>Method</td>
<td>dl/g</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>ASTM D1505</td>
<td>g/cm³</td>
<td>1.27</td>
</tr>
</tbody>
</table>

- **Optical**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haze</td>
<td>ASTM D1003</td>
<td>%</td>
<td>0.5</td>
</tr>
<tr>
<td>Total Transmittance</td>
<td>ASTM D1003</td>
<td>%</td>
<td>91</td>
</tr>
<tr>
<td>Regular Transmittance</td>
<td>ASTM D1003</td>
<td>%</td>
<td>89</td>
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</tbody>
</table>

- **Mechanical**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Unit</th>
<th>Typical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tensile Strength @ Yield</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50mm/min (2 inch/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Machine Direction (M.D)</strong></td>
<td>ASTM D882</td>
<td>MPa (kgf/cm²)</td>
<td>52 (530)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psi</td>
<td>7500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPa (kgf/cm²)</td>
<td>52 (530)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psi</td>
<td>7500</td>
</tr>
<tr>
<td><strong>Transverse Direction (T.D)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tensile Strength @ Break</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50mm/min (2 inch/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>M.D</strong></td>
<td>ASTM D882</td>
<td>MPa (kgf/cm²)</td>
<td>59 (600)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psi</td>
<td>8600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPa (kgf/cm²)</td>
<td>55 (560)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psi</td>
<td>8000</td>
</tr>
<tr>
<td><strong>T.D</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tensile Elongation @ Yield</strong></td>
<td></td>
<td>%</td>
<td>4.5</td>
</tr>
<tr>
<td>50mm/min (2 inch/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>M.D</strong></td>
<td>ASTM D882</td>
<td>%</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T.D</strong></td>
<td></td>
<td>%</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Elongation @ Break</strong></td>
<td></td>
<td>%</td>
<td>380</td>
</tr>
<tr>
<td>50mm/min (2 inch/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>M.D</strong></td>
<td>ASTM D882</td>
<td>%</td>
<td>380</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T.D</strong></td>
<td></td>
<td>%</td>
<td>380</td>
</tr>
<tr>
<td><strong>Tensile Modulus</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50mm/min (2 inch/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>M.D</strong></td>
<td>ASTM D882</td>
<td>MPa (kgf/cm²)</td>
<td>1900 (1940)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psi</td>
<td>276000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MPa (kgf/cm²)</td>
<td>1900 (1940)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>psi</td>
<td>276000</td>
</tr>
<tr>
<td><strong>T.D</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tear Propagation Resistance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split Tear Method @ 254mm/min (10 inch/min)</td>
<td>ASTM D1938</td>
<td>N (lbf)</td>
<td>9.1 (2.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/mm (lbs/in.)</td>
<td>36 (205)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact Resistance (Puncture) Energy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Load in 250 micron film</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10 mil) at 23 °C (73 °F) 220m/min.</td>
<td>ASTM D3763</td>
<td>ft-lbf</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>J</td>
<td>3.0</td>
</tr>
</tbody>
</table>

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## Processing Information

### Drying

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying temperature</td>
<td>149 deg F (65 deg C)</td>
</tr>
<tr>
<td>Drying time</td>
<td>4 – 6 Hours</td>
</tr>
<tr>
<td>Recommend residual moisture contents</td>
<td>&lt;0.05% (500 ppm)</td>
</tr>
</tbody>
</table>

### Injection Molding

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder temperature</td>
<td>473 deg F (245 deg C)</td>
</tr>
<tr>
<td>Mold temperature</td>
<td>59-104 deg F (15-40 deg C)</td>
</tr>
<tr>
<td>Speed</td>
<td>Low screw speed of 50-100 rpm</td>
</tr>
</tbody>
</table>

### Extrusion Blow Molding

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrel temperature</td>
<td>410 deg F (210 deg C)</td>
</tr>
<tr>
<td>Die temperature</td>
<td>383 deg F (195 deg C)</td>
</tr>
<tr>
<td>Mold temperature</td>
<td>54-68 deg F (12-20 deg C)</td>
</tr>
</tbody>
</table>

### Film Extrusion for 1 mm thickness

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrel temperature</td>
<td>490 deg F (255 deg C)</td>
</tr>
<tr>
<td>Die temperature</td>
<td>500 deg F (260 deg C)</td>
</tr>
<tr>
<td>Roll temperature</td>
<td>Roll 1: 90 deg F (32 deg C)</td>
</tr>
<tr>
<td></td>
<td>Roll 2: 108 deg F (42 deg C)</td>
</tr>
<tr>
<td></td>
<td>Roll 3: 149 deg F (65 deg C)</td>
</tr>
</tbody>
</table>